

# Practice Test 7

**Time Allowed:** 4 hours

**Passing Score:** 70% (88 out of 125 questions correct)

**Instructions:**

- Read each question carefully and select the BEST answer
- Mark your answers on a separate sheet
- You may use a calculator for mathematical calculations
- Answer all questions - there is no penalty for guessing
- Review your answers if time permits

**SECTION 1: PLANNING AND ESTIMATING (Questions 1-19)**

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1. What is the purpose of a pre-construction meeting?

- A. Final inspection
- B. Groundbreaking ceremony
- C. Coordinating project start including roles, communication, schedule, and procedures
- D. Contract signing

2. What is the difference between fast-track and design-build delivery?

- A. Fast-track overlaps design and construction; design-build has single entity for both
- B. Same method
- C. Cost difference only
- D. Schedule difference only

3. What is an owner-furnished item?

- A. Furniture only
- B. Material owner provides that contractor installs
- C. Contractor supplies everything
- D. Rental equipment

4. What is the difference between allowances and contingencies?

- A. Same thing
- B. Both are profit
- C. No difference
- D. Allowances are placeholders for owner selections; contingencies are reserves for unknowns

5. What is cost-loaded scheduling?

- A. Expensive schedule
- B. Heavy equipment schedule
- C. Material delivery
- D. Financial planning

6. What is earned value management (EVM)?

- A. Employee bonuses
- B. Final profit
- C. Measuring project performance comparing planned value, earned value, and actual cost
- D. Value engineering

7. What is the critical path method benefit?

- A. Finding shortcuts
- B. Identifying which activities directly impact completion time for focus
- C. Reducing quality
- D. Eliminating safety

8. What is activity float versus project float?

- A. Same concept
- B. No relationship
- C. Both are profits
- D. Activity float is for one task; project float is overall schedule flexibility

9. What is crashing a schedule?

- A. Project failure
- B. Accident
- C. Demolition work
- D. Canceling project

10. What is the cost of crashing?

- A. Free method
- B. Reduces costs
- C. Adding resources to accelerate schedule usually increasing costs
- D. Saves money always

11. What is a resource-loaded schedule?

- A. Equipment list
- B. Schedule showing required resources (labor, equipment, materials) for each activity
- C. Material costs
- D. Tool inventory

12. What is resource leveling?

- A. Equipment storage
- B. Flat organization
- C. Safety procedure
- D. Adjusting schedule to balance resource demand avoiding peaks and valleys

13. What is the difference between progress billing and milestone billing?

- A. Progress bills based on work completed; milestone bills at specific completion points
- B. Same method
- C. Cost difference only
- D. No difference

14. What is AIA G702/G703 form?

- A. Insurance form
- B. Permit application
- C. Standard application and certification for payment with continuation sheet
- D. Contract template

15. What is stored materials billing protection?

- A. Insurance policy
- B. Require proof of delivery, protect from weather, track serial numbers, verify payment to suppliers
- C. Warehouse rental
- D. No protection needed

16. What is a notice of completion?

- A. Party invitation
- B. Marketing material
- C. Building permit
- D. Formal notification project is complete starting lien deadline clock

17. What is retainage release timing?

- A. Immediately
- B. Before work starts
- C. During construction
- D. One year later

18. What is the difference between final payment and final completion?

- A. Same milestone
- B. No difference
- C. Final completion is work done; final payment is last money transfer after acceptance
- D. Timing only

19. What is a project close-out checklist?

- A. Daily task list
- B. List of final requirements including punch list, as-builts, warranties, training, and documentation
- C. Employee roster
- D. Tool inventory

## **SECTION 2: FRAMING AND STRUCTURAL COMPONENTS (Questions 20-44)**

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20. What is the difference between platform framing and balloon framing?

- A. Height difference
- B. Cost difference
- C. Material difference
- D. Platform builds floor-by-floor; balloon has continuous studs multiple stories

21. What is advanced framing (optimum value engineering)?

- A. Expensive framing method
- B. Complex framing
- C. Traditional framing
- D. Old method

22. What is the 24-inch on-center framing benefit?

- A. Stronger walls
- B. Heavier construction
- C. Reduces lumber and improves insulation space
- D. Required everywhere

23. What is a single top plate framing system?

- A. Temporary framing
- B. Advanced framing technique reducing lumber using engineered connections
- C. Weak framing
- D. Code violation

24. What is the purpose of rim joists?

- A. Temporary support
- B. Decorative element
- C. Foundation component
- D. Perimeter joists providing bearing for floor joists and enclosing floor system

25. What is blocking between joists?

- A. Short pieces between joists preventing twisting, providing fire stops, and stiffening
- B. Temporary support
- C. Decorative element
- D. Foundation work

26. What is bridging in floor framing?

- A. Connecting buildings
- B. Cross-bracing or blocking between joists providing lateral support
- C. Temporary walkway
- D. Decorative element

27. What is subfloor adhesive purpose?

- A. Temporary hold
- B. Decorative finish
- C. Waterproofing
- D. Bonding subfloor to joists reducing squeaks and increasing stiffness

28. What is the proper subfloor gap spacing?

- A. 1/8 inch gaps between panels for expansion
- B. No gaps needed
- C. 1 inch gaps
- D. Tight fit required

29. What is an I-joist?

- A. Interstate joist
- B. Italian joist
- C. Engineered lumber joist with wood flanges and OSB or plywood web
- D. Steel joist

30. What are I-joist advantages?

- A. Heavier than solid lumber
- B. Longer spans, lighter weight, dimensional stability, and consistent strength
- C. More expensive always
- D. Harder to install

31. What is LVL lumber?

- A. Low Value Lumber
- B. Laminated lumber
- C. Lightweight lumber
- D. Laminated Veneer Lumber made from bonded wood veneers

32. What is a flush beam versus a drop beam?

- A. Same installation
- B. No difference
- C. Flush beam sits level with joists; drop beam hangs below joists
- D. Strength difference only

33. What is a strongback in ceiling framing?

- A. Worker designation
- B. Lateral bracing across ceiling joists preventing sagging
- C. Decorative element
- D. Temporary support

34. What is the purpose of let-in bracing?

- A. Temporary support
- B. Diagonal bracing notched into studs providing lateral stability
- C. Decorative element
- D. Future expansion

35. What is metal cross-bracing?

- A. Decorative element
- B. Temporary support
- C. Plumbing support
- D. Flat metal straps diagonally connecting studs resisting lateral forces

36. What is the difference between lateral and vertical loads?

- A. Lateral loads act horizontally (wind, earthquake); vertical loads act downward (gravity)
- B. Same loads
- C. No difference
- D. Lateral are stronger

37. What is a shear wall schedule?

- A. Work schedule
- B. Payment schedule
- C. Drawing showing location, nailing, and hardware for shear walls
- D. Material delivery

38. What is nailing schedule on plans?

- A. Work schedule
- B. Specification of nail types, sizes, and spacing for connections
- C. Delivery schedule
- D. Payment schedule

39. What is a prescriptive path versus engineered design?

- A. Same approach
- B. No difference
- C. Cost difference
- D. Prescriptive follows code tables; engineered has custom calculations

40. When is engineered design required?

- A. For complex, larger, or non-standard buildings exceeding prescriptive limits
- B. Never required
- C. Small projects only
- D. Always optional

41. What is a beam pocket?

- A. Storage space
- B. Tool pocket
- C. Recess in wall or foundation for beam bearing
- D. Decorative element

42. What is bearing length for beams?

- A. Beam length
- B. Minimum contact length between beam and support
- C. Total length
- D. Decorative length

43. What is shrinkage in wood framing?

- A. Theft reduction
- B. Wood dimensional change from moisture loss
- C. Cost reduction
- D. Strength increase

44. What is the difference between dimensional lumber shrinkage across versus along grain?

- A. Wood shrinks significantly across grain but minimally along grain
- B. Equal shrinkage
- C. No shrinkage occurs
- D. Shrinks more along grain

### **SECTION 3: CORE TRADES (Questions 45-82)**

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45. What is a backflow preventer?

- A. Drainage device
- B. Pressure regulator
- C. Device preventing contaminated water from flowing back into potable supply
- D. Filter

46. What is a reduced pressure zone (RPZ) backflow preventer?

- A. Simple check valve
- B. High-level protection device using pressure differential and relief valve

- C. Decorative valve
- D. Temporary device

47. What is a double-check valve assembly?

- A. Two regular valves
- B. Temporary valves
- C. Decorative valves
- D. Backflow preventer with two check valves for moderate-hazard protection

48. What is cross-connection in plumbing?

- A. Intersection
- B. Temporary connection
- C. Decorative feature
- D. Structural support

49. What is an atmospheric vacuum breaker?

- A. HVAC component
- B. Pressure device
- C. Simple backflow device for non-continuous pressure applications
- D. Decorative valve

50. What is a pressure vacuum breaker?

- A. Simple valve
- B. Atmospheric vacuum breaker with spring-loaded check for continuous pressure

- C. Decorative device
- D. Temporary valve

51. What is a fixture unit in plumbing?

- A. Fixture cost
- B. Fixture size
- C. Fixture weight
- D. Measure of water supply demand or drainage load for sizing pipes

52. What is the purpose of fixture unit calculations?

- A. Pricing fixtures
- B. Sizing supply pipes and drains based on total fixture load
- C. Scheduling installation
- D. Decorative planning

53. What is minimum trap size for a toilet?

- A. 3 inches (sometimes 4 inches)
- B. 1-1/2 inches
- C. 2 inches
- D. 6 inches

54. What is minimum trap size for a lavatory?

- A. 3 inches
- B. 2 inches

- C. 1-1/4 inches (code minimum though 1-1/2 inches preferred)
- D. 4 inches

55. What is a trap weir?

- A. Decorative element
- B. Water level in trap providing seal
- C. Trap material
- D. Trap installation

56. What is trap seal depth?

- A. Trap length
- B. Trap width
- C. Trap cost
- D. Vertical water depth in trap providing sewer gas seal

57. What is the minimum trap seal depth required?

- A. 2 inches minimum (typically 2-4 inches)
- B. 1/2 inch
- C. 6 inches
- D. 1 inch

58. What is trap arm length?

- A. Trap size
- B. Trap weight

- C. Horizontal distance from trap to vent connection
- D. Trap depth

59. What is the relationship between trap arm length and pipe size?

- A. No relationship
- B. Larger pipes allow longer trap arms
- C. Smaller pipes allow longer arms
- D. Always same length

60. What is a vent stack versus a stack vent?

- A. Same thing
- B. Cost difference
- C. No difference
- D. Vent stack is separate; stack vent is toilet stack extension above highest fixture

61. What is a circuit vent?

- A. Electrical vent
- B. Decorative vent
- C. Temporary vent
- D. One vent for multiple traps

62. What is combination waste and vent system?

- A. Old system
- B. Temporary system

- C. System where pipes serve as both drain and vent for specific fixtures
- D. Decorative system

63. What is the difference between Schedule 40 and Schedule 80 PVC?

- A. Color difference
- B. Schedule 80 has thicker walls and higher pressure rating
- C. Length difference
- D. No difference

64. What is DWV pipe?

- A. Deep Water Valve
- B. Double Wall Vent
- C. Decorative Wall Vent
- D. Drain Waste Vent pipe rated for drainage systems

65. What is ABS pipe?

- A. Anti-lock Brake System
- B. Temporary pipe
- C. Decorative pipe
- D. Expensive pipe

66. What is the proper slope for drain lines?

- A. Level installation
- B. Maximum slope

- C. 1/4 inch per foot minimum for most drains (sometimes 1/8 inch for larger pipes)
- D. 1 inch per foot

67. What is a cleanout required location?

- A. Every 10 feet
- B. At direction changes, base of stacks, and where access for cleaning is needed
- C. Never required
- D. Only at building exits

68. What is a floor drain trap primer connection?

- A. Electrical connection
- B. Gas connection
- C. Decorative connection
- D. Water supply providing periodic water maintaining trap seal

69. What is electrical service capacity measured in?

- A. Amperes (amps)
- B. Volts
- C. Watts
- D. Ohms

70. What is typical residential service size?

- A. 60 amps
- B. 400 amps

- C. 100-200 amps (200 amp increasingly standard)
- D. 20 amps

71. What is the difference between service entrance conductors and branch circuits?

- A. Same wires
- B. Service entrance connects utility to panel; branch circuits distribute from panel to loads
- C. No difference
- D. Color only

72. What is a main breaker?

- A. First switch
- B. Backup breaker
- C. Temporary breaker
- D. Master disconnect shutting off all power from utility feed

73. What is a sub-panel?

- A. Smaller panel fed from main panel extending circuits to remote areas
- B. Main panel
- C. Temporary panel
- D. Decorative panel

74. What is the advantage of sub-panels?

- A. No advantage
- B. More expensive

- C. Bringing power to remote areas reducing wire runs and voltage drop
- D. Decorative only

75. What is a transfer switch?

- A. Light switch
- B. Device switching between utility and generator power
- C. Circuit breaker
- D. Temporary switch

76. What is the difference between manual and automatic transfer switches?

- A. Automatic switches between utility and generator automatically; manual requires operator
- B. Same operation
- C. Cost only
- D. No difference

77. What is SEER rating in air conditioning?

- A. Cost rating
- B. Size measurement
- C. Seasonal Energy Efficiency Ratio measuring cooling efficiency
- D. Color code

78. What is a higher SEER rating?

- A. Worse efficiency
- B. More efficient system with lower operating costs

- C. Lower cost
- D. No difference

79. What is a heat pump defrost cycle?

- A. System failure
- B. Normal operation
- C. Emergency mode
- D. Reverses refrigerant flow melting frost on outdoor coil during heating

80. What is outdoor reset control?

- A. Restarting outdoor unit
- B. Temperature control adjusting system based on outdoor temperature
- C. Emergency stop
- D. Manual override

81. What is a condensate pump?

- A. Water pump
- B. Air pump
- C. Pump removing condensate water from HVAC equipment
- D. Fuel pump

82. What is condensate line slope?

- A. Level installation
- B. Minimum 1/4 inch per foot slope toward drain preventing standing water

- C. Maximum slope
- D. No slope needed

#### **SECTION 4: FINISH TRADES (Questions 83-107)**

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83. What is primer purpose before painting?

- A. Final coat
- B. Decorative layer
- C. Optional step
- D. Sealing surface, improving adhesion, and blocking stains

84. What is shellac-based primer best for?

- A. Exterior only
- B. Metal only
- C. Concrete
- D. Wet areas

85. What is bonding primer versus regular primer?

- A. Same product
- B. No difference
- C. Bonding primer adheres to glossy or difficult surfaces better
- D. Cost only

86. What is paint hide?

- A. Animal skin
- B. Ability to cover previous colors or surfaces completely
- C. Storage method
- D. Drying time

87. What is paint coverage rate?

- A. Square feet per gallon
- B. Drying time
- C. Color intensity
- D. Square feet per gallon varies by surface texture and application

88. What causes paint to peel?

- A. Perfect preparation
- B. Proper application
- C. Ideal conditions
- D. Good adhesion

89. What is paint alligatoring?

- A. Smooth finish
- B. Perfect paint
- C. Pattern of deep cracks resembling alligator skin from incompatible layers
- D. Decorative technique

90. What is the proper paint temperature range?

- A. Freezing temperatures
- B. 50-85°F typically for application and curing
- C. Above 100°F
- D. Any temperature

91. What is hardwood flooring acclimation?

- A. Storage
- B. Installation
- C. Cleaning
- D. Finishing

92. What is the purpose of flooring acclimation?

- A. No purpose
- B. Waste time
- C. Required storage
- D. Allowing flooring to adjust to space humidity preventing expansion/contraction issues

93. What is tongue and groove hardwood flooring?

- A. Flat boards
- B. Temporary flooring
- C. Flooring with interlocking edges providing solid connection between boards
- D. Decorative pattern

94. What is the advantage of engineered hardwood versus solid?

- A. No advantage
- B. More expensive always
- C. Temporary flooring
- D. Less expensive always

95. What is hardwood flooring expansion gap?

- A. No gap needed
- B. Space around room perimeter allowing expansion preventing buckling
- C. Decorative feature
- D. Installation error

96. What is the typical expansion gap size for hardwood?

- A. No gap
- B. 1 inch
- C. 2 inches
- D. 1/2 inch

97. What is floating floor installation?

- A. Submerged installation
- B. Temporary installation
- C. Decorative installation
- D. Expensive installation

98. What is vapor barrier under hardwood on concrete?

- A. Optional
- B. Decorative
- C. Moisture barrier preventing concrete moisture from damaging wood
- D. Temporary layer

99. What is the purpose of underlayment under laminate?

- A. Decoration
- B. Sound dampening, moisture protection, and smoothing minor imperfections
- C. Structural support
- D. Increasing height

100. What is click-lock flooring?

- A. Security system
- B. Traditional installation
- C. Temporary flooring
- D. Flooring with mechanical interlocking system requiring no glue or nails

101. What is LVP flooring?

- A. Low Value Product
- B. Laminate Vinyl Plank
- C. Luxury Vinyl Plank waterproof resilient flooring
- D. Large Vinyl Panel

102. What is SPC flooring?

- A. Special Product Category
- B. Stone Plastic Composite rigid core vinyl flooring
- C. Standard Plank Category
- D. Simple Plastic Construction

103. What is WPC flooring?

- A. Water Plank Construction
- B. Wood Product Composite
- C. Weak Plastic Construction
- D. Wood Plastic Composite flexible core vinyl flooring

104. What is the difference between SPC and WPC vinyl flooring?

- A. SPC is rigid with stone core; WPC is softer with wood-plastic core
- B. Same product
- C. No difference
- D. Color only

105. What is baseboards' primary purpose?

- A. Structural support
- B. Load bearing
- C. Covering gap between walls and flooring providing finished appearance
- D. Insulation

106. What is coping a baseboard joint?

- A. Mitering corners
- B. Cutting profile of one piece to fit tightly against another at inside corners
- C. Straight cuts
- D. Temporary connection

107. What is the advantage of coped joints versus mitered?

- A. No advantage
- B. Faster installation
- C. Cheaper
- D. Coped joints stay tight as wood shrinks; mitered joints open gaps

## **SECTION 5: SAFETY (Questions 108-125)**

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108. What is a competent person designation?

- A. Anyone on site
- B. Newest worker
- C. Any supervisor
- D. Cheapest option

109. What is lockout/tagout (LOTO)?

- A. Security system
- B. Leaving work
- C. Locking doors
- D. Storage locks

110. What is the purpose of lockout/tagout?

- A. Security
- B. Preventing accidental equipment energization during maintenance
- C. Access control
- D. Inventory control

111. What is a personal lockout device?

- A. House key
- B. Vehicle lock
- C. Storage lock
- D. Individual lock ensuring only the person who locked equipment can unlock it

112. What is a hot work permit?

- A. Summer work authorization
- B. Temperature certification
- C. Weather permit
- D. Overtime authorization

113. What must be verified before hot work?

- A. Time of day
- B. Weather
- C. Fire watch, flammable materials removed, extinguishers available, area monitoring
- D. Lunch schedule

114. What is a fire watch?

- A. Watching fires
- B. Designated person monitoring area during and after hot work for fire hazards
- C. Security guard
- D. Time keeping

115. How long should fire watch continue after hot work?

- A. Not needed after work
- B. 5 minutes
- C. Until shift ends
- D. At least 30-60 minutes after completion watching for delayed ignition

116. What is the purpose of a fall protection plan?

- A. Autumn planning
- B. Budget planning
- C. Documenting fall hazards and protection methods for elevated work
- D. Schedule planning

117. What is a controlled access zone?

- A. Security area
- B. Designated area limiting access to workers performing specific tasks
- C. Storage area
- D. Parking area

118. What is warning line system?

- A. Alarm system
- B. Ropes or chains marking boundaries where fall protection is required beyond
- C. Electrical warning
- D. Temporary barrier

119. What is a safety monitor?

- A. Computer equipment
- B. Video camera
- C. Alarm system
- D. Security guard

120. When can a safety monitor be used instead of fall protection?

- A. Always acceptable
- B. Limited situations on low-slope roofs when conventional protection is infeasible
- C. Never acceptable
- D. Small jobs only

121. What is excavation competent person responsibility?

- A. Operating equipment
- B. Cost control
- C. Inspecting excavations daily and classifying soil determining protection needs
- D. Scheduling work

122. What is Type A soil?

- A. Weakest soil
- B. Most stable soil with high cohesion and strength
- C. Average soil
- D. Clay only

123. What is Type C soil?

- A. Strongest soil
- B. Medium soil
- C. Gravel
- D. Least stable soil requiring maximum protection

124. What is the minimum trench width for worker access?

- A. 18 inches
- B. 36 inches
- C. 12 inches
- D. Any width

125. What is sloping in excavation safety?

- A. Digging at angle
- B. Level excavation
- C. Cutting excavation sides at safe angle preventing cave-ins
- D. Using equipment



## Answer Key with Explanations

- 1. C** - Pre-construction meetings bring together all project stakeholders (owner, contractor, architect, subcontractors, suppliers) before starting work. They establish communication protocols, review schedules, clarify roles and responsibilities, discuss site logistics, verify insurance and bonds, and ensure everyone understands project requirements. Good pre-construction meetings prevent misunderstandings and set projects up for success.
- 2. A** - Fast-tracking overlaps design and construction phases—you start building before designs are complete. Design-build is a delivery method where one entity handles both design and construction under a single contract. Fast-track describes scheduling; design-build describes contract structure. You can fast-track design-build projects or traditionally delivered projects.
- 3. B** - Owner-furnished items are materials the owner purchases and provides that contractors install. The owner might buy expensive light fixtures or specialty equipment directly, and you install them. Clearly define responsibilities—who receives, stores, inspects, and warrants owner-furnished items? Installation warranty is typically yours; product warranty is the owner's responsibility.
- 4. D** - Allowances are placeholder amounts for owner-selected items (fixtures, flooring, appliances) where exact products aren't specified at contract time. Contingencies are reserve funds for unforeseen conditions, changes, or estimating uncertainties. Allowances eventually convert to actual costs; contingencies may or may not get used.
- 5. A** - Cost-loaded scheduling assigns dollar values to each schedule activity showing planned cash flow over time. It links schedule and budget helping predict when money is needed, track earned value, forecast final costs, and verify progress payment requests. Cost-loaded schedules are essential financial management tools.
- 6. C** - Earned Value Management integrates scope, schedule, and cost measuring project performance. It compares planned value (budgeted cost of scheduled work), earned value (budgeted cost of completed work), and actual cost (actual spending) revealing if you're ahead or behind schedule and over or under budget simultaneously.
- 7. B** - The critical path method identifies the longest sequence of dependent activities determining minimum project duration. Activities on the critical path have zero float—any delay directly extends completion. Knowing the critical path lets you focus resources where delays matter most, optimize schedules, and manage risk effectively.
- 8. D** - Activity float (slack) is schedule flexibility for individual activities—how long one activity can delay without impacting completion. Project float is overall schedule flexibility—how long the entire project can delay beyond early completion without missing contractual completion. Activity float varies; project float applies to the whole project.
- 9. A** - Crashing a schedule means adding resources (more workers, overtime, better equipment, multiple shifts) to compress activity durations and accelerate completion. You "crash" critical path activities since non-critical activities have float and won't speed completion. Crashing costs more but finishes earlier.

**10. C** - Crashing almost always increases costs—overtime pay, premium pricing for expedited materials, inefficiencies from congestion, and premium rates for rush work. Sometimes crashing saves money by avoiding liquidated damages or capturing early completion bonuses, but the crashing itself costs more than normal-pace work.

**11. B** - Resource-loaded schedules show required resources (labor, equipment, materials) for each activity. You can see that Activity A needs 5 carpenters and a crane while Activity B needs 3 electricians. This helps plan resource procurement, identify conflicts when multiple activities need the same resource, and level resources.

**12. D** - Resource leveling adjusts schedules to avoid resource overloads by shifting activities with float to smooth resource demand. If three activities need 10 workers simultaneously but you only have 10 total, leveling shifts some activities preventing the conflict. Leveling often extends schedules but prevents resource shortages.

**13. A** - Progress billing bills monthly based on work completed (percentage of each category in schedule of values). Milestone billing bills when specific project milestones are achieved (foundation complete, building dried-in, substantial completion). Progress billing provides steady cash flow; milestone billing has irregular payments.

**14. C** - AIA G702 is the Application and Certification for Payment (summary sheet showing total contract, previous payments, current application, and balance). G703 is the Continuation Sheet listing each schedule of values line item with percentages complete and dollar amounts. They're the standard forms for payment applications.

**15. B** - Protect stored materials billing by requiring proof of delivery with photos and documentation, protecting materials from weather and theft, tracking serial numbers on equipment, storing materials in secure areas, photographing storage, and verifying you've paid suppliers. Without protection, stored materials could disappear or be damaged costing you twice.

**16. D** - Notice of Completion is formal recorded notice that projects are complete starting the clock on lien deadlines. Once recorded, subcontractors and suppliers have limited time (often 30-90 days depending on state) to file liens. Without Notice of Completion, lien deadlines extend much longer.

**17. B** - Retainage typically releases at final completion after punch lists are complete, final inspection passes, and owners accept the work. Some contracts release partial retainage at substantial completion with the balance at final completion. Some states mandate early retainage release to improve contractor cash flow.

**18. C** - Final completion means all work is 100% done—punch list complete, all documentation submitted, final inspection passed, and owner accepts the work. Final payment is the last money transfer after final completion including retained amounts. You must achieve final completion before receiving final payment.

**19. B** - Project close-out checklists document all final requirements including punch list completion, as-built drawings, warranties, training for owner's staff, O&M manuals, final inspection, lien waivers, Notice

of Completion, and final accounting. Comprehensive checklists ensure nothing gets forgotten during the hectic close-out phase.

**20. D** - Platform framing builds one floor at a time—first floor walls on first floor platform, second floor platform on first floor walls, second floor walls on second floor platform. Balloon framing uses continuous studs running from foundation to roof with floors framed into studs. Platform framing is standard today; balloon framing is historical.

**21. A** - Advanced framing (also called optimum value engineering or OVE) uses framing techniques reducing lumber while maintaining strength—24-inch stud spacing, single top plates, two-stud corners, fewer cripples, and aligning framing members. It reduces thermal bridging, increases insulation space, saves lumber, and cuts costs without sacrificing performance.

**22. C** - Twenty-four-inch on-center spacing uses fewer studs than 16-inch spacing saving lumber costs, provides larger insulation cavities improving energy efficiency, reduces thermal bridging, and speeds framing. It requires proper engineering and larger sheathing but works well for many applications especially with advanced framing techniques.

**23. B** - Single top plate systems use one top plate instead of doubled plates in advanced framing. They require engineering connections (straps, clips) at intersections and require careful alignment of studs, joists, and rafters. Properly engineered single plates save lumber without compromising strength.

**24. D** - Rim joists (also called band joists or header joists) are perimeter joists closing the ends of floor joist bays providing bearing surfaces for floor joists and enclosing floor systems. They transfer wall loads to foundations, provide nailing for sheathing and siding, and create the perimeter band around floor systems.

**25. A** - Blocking consists of short pieces installed between joists preventing rotation and twisting, providing fire stops, stiffening floor systems, and providing backing for finishes. Blocking at joist mid-spans reduces bounce. Blocking at bearing points transfers loads. It's essential for solid floor performance.

**26. B** - Bridging (cross-bracing or solid blocking) connects joists laterally distributing loads, stiffening floors, and preventing joist twisting. Metal cross-bracing or solid wood blocking both work. Bridging reduces floor bounce and improves performance. Modern construction often uses structural sheathing instead which provides similar benefits.

**27. D** - Subfloor adhesive bonds subfloor panels to joists creating glued-and-screwed assemblies much stiffer than nails alone. Adhesive eliminates squeaks from movement between panels and joists, increases floor stiffness, and improves performance. It's essential for quality construction preventing the squeaky floors that develop over time.

**28. A** - Leave 1/8-inch gaps between subfloor panels allowing expansion from moisture absorption. Tight-fit panels with no gaps buckle and squeak when they expand. The small gaps accommodate movement preventing problems. Tongue-and-groove panels still need end gaps even though edges interlock.

**29. C** - I-joists are engineered lumber joists with wood flanges (top and bottom chords) and OSB or plywood webs creating I-beam shapes. They're manufactured to precise dimensions, resist warping, allow long spans, accept long lengths, and provide consistent performance. Most modern floors use I-joists or engineered lumber.

**30. B** - I-joists span farther than solid lumber of similar size, are lighter and easier to handle, won't warp or crown, come in longer lengths, provide dimensional stability, and offer consistent engineered performance. They're more expensive than dimensional lumber but the performance benefits usually justify costs. Proper installation is critical—follow manufacturer requirements.

**31. D** - LVL (Laminated Veneer Lumber) consists of thin wood veneers bonded together with grain running parallel creating extremely strong beams and headers. LVL is much stronger than solid lumber, comes in large sizes, provides consistent performance, and handles concentrated loads. It's the go-to choice for long-span beams and heavy headers.

**32. C** - Flush beams install level with joist tops allowing subfloor to run continuously over beams. Joists connect to flush beams with hangers. Drop beams hang below joists with joists bearing on top of beams. Flush beams maintain ceiling heights and allow continuous subfloor; drop beams are simpler to install but reduce headroom.

**33. B** - Strongbacks are continuous lateral braces installed perpendicular to ceiling joists preventing sagging and providing straight, flat ceilings. They're typically 2×4 or 2×6 members running across joists held with blocks and nails. Strongbacks dramatically improve ceiling flatness especially for drywall ceilings where any sag shows.

**34. B** - Let-in bracing consists of diagonal braces (typically 1×4 boards) notched into wall studs providing lateral stability. The braces are "let in" by cutting notches so they're flush with stud faces. Let-in bracing was common before structural sheathing became standard. Some applications still use it supplementing sheathing.

**35. D** - Metal cross-bracing (also called tension bracing or T-bracing) uses flat metal straps nailed diagonally across studs forming X-patterns resisting lateral forces. Metal bracing is quick to install and effective for lateral stability. It's often used in interior walls that don't have structural sheathing.

**36. A** - Lateral loads act horizontally—wind pushing on walls, earthquakes shaking buildings sideways. Vertical loads act downward from gravity—roof weight, floor loads, snow, furniture, occupants. Buildings must resist both. Lateral loads are often more challenging requiring shear walls, bracing, and special connections.

**37. C** - Shear wall schedules are drawings showing shear wall locations, dimensions, sheathing types, nailing patterns (edge nailing and field nailing spacing), boundary framing, hold-down hardware, and all specifications for lateral force resistance. They're critical construction documents ensuring shear walls are built correctly.

**38. B** - Nailing schedules specify nail types, sizes (length and diameter), and spacing for all connections throughout construction. They tell you to use 8d nails at 6 inches on center for sheathing edges or 16d nails for framing connections. Following nailing schedules ensures proper strength and code compliance.

**39. D** - Prescriptive paths follow code tables and standard details for conventional construction—typical houses, standard spans, normal loading. Engineered design involves custom calculations by engineers for non-standard conditions—long spans, heavy loads, unusual configurations. Prescriptive is simpler and cheaper; engineered is required when conditions exceed prescriptive limits.

**40. A** - Engineered design is required when buildings exceed prescriptive limits—larger than code tables allow, unusual designs, complex structures, difficult sites, high wind or seismic zones, or when conventional construction won't work. Engineers calculate exact requirements for specific conditions providing safe custom designs.

**41. C** - Beam pockets are recesses formed in concrete walls or foundations providing bearing surfaces for beams. The recess is sized for the beam end allowing proper bearing length and providing solid support. Beam pockets must be correctly located during concrete work—fixing mistakes later is nearly impossible.

**42. B** - Bearing length is the minimum contact length between beams and supports ensuring adequate load transfer without crushing. Typical minimums are 1-1/2 to 3 inches depending on loads and materials. Insufficient bearing causes concentrated stress crushing wood or concrete. Engineers specify required bearing lengths.

**43. B** - Wood shrinkage is dimensional change from moisture loss as lumber dries. Green lumber contains significant moisture. As it dries to equilibrium with surrounding air, it shrinks. The dimensional change causes problems if not accounted for—doors stick, gaps open, floors become uneven.

**44. A** - Wood shrinks 6-8% across grain (perpendicular to growth rings) but only 0.1-0.2% along grain (parallel to fibers). This is why 2×10 joists shrink significantly in the 9.25-inch dimension but don't shrink measurably in length. Understanding this prevents problems—minimize cross-grain lumber in vertical dimensions.

**45. C** - Backflow preventers are devices stopping contaminated water from flowing backward into potable water supplies. Without them, siphoning can draw contaminated water back into drinking water systems. They're required wherever contamination risks exist—irrigation systems, boilers, chemical feeders, and other non-potable connections.

**46. B** - RPZ (Reduced Pressure Zone) backflow preventers provide the highest level of protection for high-hazard situations. They use differential pressure zones and relief valves preventing backflow even under back-pressure conditions. RPZs are required for fire sprinkler systems, irrigation, and other high-risk connections.

**47. D** - Double-check valve assemblies use two independent check valves in series providing moderate protection for moderate-hazard applications. If one check valve fails, the second provides backup. They're suitable for non-health hazard situations but not high-hazard applications requiring RPZ protection.

**48. A** - Cross-connections are physical connections between potable water and non-potable sources creating contamination risks. A hose submerged in a pool, a drinking fountain plumbed backwards, or a boiler connected without protection are cross-connections. Eliminating cross-connections or installing backflow prevention protects drinking water.

**49. C** - Atmospheric vacuum breakers are simple devices opening to atmosphere when pressure drops preventing backsiphonage. They're inexpensive and effective for non-continuous pressure applications like hose bibbs. They must be installed above fixtures and can't be under constant pressure—no valves downstream.

**50. B** - Pressure vacuum breakers add spring-loaded check valves to atmospheric vacuum breakers allowing continuous pressure. They work under constant pressure but still must install above fixtures. PVBs are common for irrigation systems and other outdoor applications needing constant pressure protection.

**51. D** - Fixture units are standardized measures representing typical water supply demand or drainage load from fixtures. A toilet might be 4 fixture units; a lavatory 1 fixture unit. You add fixture units for all fixtures then use tables to size pipes. It's a simplified method for sizing plumbing systems.

**52. B** - Fixture unit calculations size supply pipes and drains based on total connected load. Count all fixtures, convert to fixture units, look up required pipe sizes in tables. This ensures pipes are large enough for peak demand without oversizing wasting money. Proper sizing prevents pressure loss and drainage problems.

**53. A** - Toilets require 3-inch minimum traps (some building codes require 4 inches). The large trap handles solid waste. Smaller traps would clog constantly. The toilet trap is built into the fixture—you don't install separate P-traps under toilets like you do for sinks.

**54. C** - Lavatories (bathroom sinks) require 1-1/4-inch minimum trap size by code though 1-1/2 inches is preferred and more common. The 1-1/4-inch minimum is barely adequate—1-1/2 inches drains better and clogs less. Most modern lavatory P-traps are 1-1/2 inches.

**55. B** - The trap weir is the water level in the trap—the highest point water must flow over to drain. It creates the water seal preventing sewer gases from entering buildings. Proper weir depth ensures adequate seal. Trap design maintains water at the correct level.

**56. D** - Trap seal depth is the vertical water depth in traps from the weir (overflow point) to the dip (bottom of trap). This water column creates the barrier preventing sewer gases from passing through. Adequate seal depth ensures gases can't push through or evaporate away.

**57. A** - Minimum trap seal depth is 2 inches with typical range 2-4 inches. Less than 2 inches and seals evaporate quickly or can be blown out by pressure fluctuations. More than 4 inches and traps take longer to refill and may siphon more easily. The 2-4 inch range provides reliable seals.

**58. C** - Trap arm length is the horizontal distance from trap outlet to vent connection. It's the most critical dimension in venting—too long and traps siphon. Code tables specify maximum trap arm lengths based on pipe size. Larger pipes allow longer trap arms because they resist siphoning better.

**59. B** - Larger pipes allow longer trap arms because they're harder to siphon. A 1-1/2-inch lavatory trap might allow 3.5 feet trap arm; a 3-inch toilet trap might allow 6 feet. The relationship is in code tables. Exceed maximum trap arm length and traps siphon losing their seals.

**60. D** - Vent stacks are separate vertical pipes dedicated to venting—they don't carry drainage. Stack vents are vertical drain stacks (like toilet stacks) that extend above the highest fixture becoming vents. Below the highest fixture they're drains; above they're vents. The terminology is confusing but the distinction matters for code compliance.

**61. A** - Circuit vents serve multiple traps on the same horizontal branch—like a bathroom vanity and tub sharing one vent. The vent connects downstream of fixtures allowing one vent to protect multiple traps. Circuit venting saves pipe and is specifically allowed by code under certain conditions.

**62. C** - Combination waste and vent systems allow pipes to serve as both drain and vent for specific fixtures under limited conditions. Horizontal drains carry waste but also provide venting for fixtures. Strict limitations apply—pipe sizes must be larger than normal, slopes must be specific, and only certain fixtures qualify.

**63. B** - Schedule 80 PVC has much thicker walls than Schedule 40 providing higher pressure ratings and greater strength. Schedule 80 is more expensive and harder to work with but necessary for high-pressure applications or exposed locations needing impact resistance. Schedule 40 is standard for most building plumbing.

**64. D** - DWV stands for Drain Waste Vent—pipe specifically rated for gravity drainage systems. DWV pipe has thinner walls than pressure-rated pipe since drainage systems aren't pressurized. Don't use DWV pipe for supply lines—it will fail under pressure. DWV is for drains and vents only.

**65. A** - ABS (Acrylonitrile Butadiene Styrene) is black plastic pipe used for DWV systems. It's similar to white PVC but slightly more impact-resistant and flexible. ABS uses solvent cement without primer (just one-step cement). Some codes don't allow ABS; others allow it for drains. Check local code.

**66. C** - Standard drain slope is 1/4 inch per foot (2% slope) for most drain lines. Steeper is acceptable but not required; flatter risks clogging. Larger drains (3-inch and bigger) can sometimes use 1/8 inch per foot. Proper slope ensures self-cleaning velocity carrying solids without clogging.

**67. B** - Cleanouts are required at direction changes (especially horizontal changes over 45 degrees), at the base of soil stacks, and wherever access is needed for cleaning. Maximum spacing between cleanouts varies by pipe size (often 100 feet). Cleanouts must be accessible—don't bury them in walls.

**68. D** - Floor drain trap primers connect to water supply providing periodic small water flows maintaining trap seals in infrequently used floor drains. Without primers, floor drain traps evaporate allowing sewer

gases into buildings. Primers can be manual valves, automatic pressure-activated devices, or electronic controls.

**69. A** - Electrical service capacity is measured in amperes (amps) representing the maximum current the service can supply. A 200-amp service can supply up to 200 amps of current continuously. Total connected load must not exceed service capacity accounting for demand factors.

**70. C** - Typical modern residential service is 200 amps though 100 amps remains minimum code in some areas. 200-amp service handles modern electrical loads—HVAC, kitchen appliances, multiple computers, and potential future needs like EV charging. Older homes often have 100 or 150 amp service sometimes requiring upgrades.

**71. B** - Service entrance conductors run from utility connection to service panel bringing power into buildings. Branch circuits run from panels to loads (outlets, fixtures, appliances) distributing power throughout buildings. Service conductors handle total building load; branch circuits handle individual circuit loads.

**72. D** - Main breakers are master disconnects at service entrances shutting off all power to buildings from utility feeds. They're the first point of disconnect and provide overcurrent protection for the entire service. In emergencies, the main breaker shuts down everything instantly.

**73. A** - Sub-panels are additional panels fed from main panels extending circuits to remote building areas. The main panel feeds sub-panels through large feeder circuits. Sub-panels have their own breakers distributing power to local circuits. They eliminate long wire runs reducing voltage drop and saving copper.

**74. C** - Sub-panels bring power to remote areas reducing wire lengths and voltage drop. Instead of running 100-foot circuits from the main panel, run one large feeder to a sub-panel then short circuits to local loads. This saves money on wire and improves voltage. Sub-panels also provide more circuit spaces.

**75. B** - Transfer switches automatically or manually switch between utility power and generator power. When utility fails, the transfer switch disconnects utility and connects generator preventing backfeed and ensuring safe operation. They're essential for backup generator systems.

**76. A** - Automatic transfer switches sense utility failure and automatically switch to generator power without operator intervention. Manual transfer switches require physically switching between sources. Automatic switches provide seamless backup; manual switches are cheaper but need someone to operate them during outages.

**77. C** - SEER (Seasonal Energy Efficiency Ratio) measures air conditioner and heat pump cooling efficiency—the ratio of cooling output (BTUs) to electrical energy input (watt-hours) over a season. Higher SEER means more efficient cooling using less electricity. Minimum SEER has increased over years as efficiency improves.

**78. B** - Higher SEER ratings mean more efficient systems using less electricity for the same cooling. A 20 SEER system uses roughly half the electricity of a 10 SEER system. Higher SEER equipment costs more initially but saves money long-term through reduced utility bills.

**79. D** - Heat pump defrost cycles periodically reverse refrigerant flow heating the outdoor coil and melting accumulated frost during heating operation. Frost blocks airflow reducing efficiency. The system temporarily switches to cooling mode (heating outdoor coil, cooling indoor). Backup heat maintains indoor comfort during short defrost cycles.

**80. B** - Outdoor reset controls adjust system operation based on outdoor temperature optimizing efficiency. As outdoor temperature changes, the control modifies supply temperatures, cycle timing, or other parameters matching actual heating or cooling needs. They significantly improve efficiency especially with hydronic heating systems.

**81. C** - Condensate pumps remove water condensing from cooling coils when gravity drainage isn't possible. Air conditioning and high-efficiency furnaces produce significant condensate. If equipment is below drain level, pumps lift water to drains. Small pumps with reservoirs and float switches operate automatically.

**82. B** - Condensate lines should slope minimum 1/4 inch per foot toward drains allowing gravity flow and preventing standing water breeding mold and bacteria. Inadequate slope creates standing water, slow drainage, and eventual clogs. Proper slope ensures reliable drainage.

**83. D** - Primer seals porous surfaces preventing topcoat absorption, improves adhesion creating bond between surfaces and topcoats, blocks stains preventing bleed-through, and provides uniform base for topcoats. Primer is essential for quality paint jobs—don't skip it trying to save money.

**84. A** - Shellac-based primers (like BIN or Kilz) excel at blocking stubborn stains—water stains, smoke damage, marker, crayon, and tannin bleed-through from wood. They dry extremely fast (minutes), adhere to glossy surfaces, and create superb stain barriers. They're solvent-based requiring alcohol cleanup and good ventilation.

**85. C** - Bonding primers have special formulations improving adhesion to difficult surfaces—glossy paint, tile, glass, metal, or other non-porous surfaces where regular primer won't stick. They create mechanical and chemical bonds to slick surfaces. Use bonding primer when painting over questionable surfaces without sanding.

**86. B** - Paint hide (hiding power or coverage) is the ability to cover previous colors or surfaces completely making them invisible. Good hide covers in one coat; poor hide requires multiple coats. High-quality paints with higher pigment content have better hide than cheap paints.

**87. D** - Paint coverage rate (square feet per gallon) varies significantly by surface texture and porosity. Smooth drywall might get 400 square feet per gallon; rough stucco might only get 150. Manufacturer data provides estimates but actual coverage varies. Porous surfaces absorb more paint reducing coverage.

**88. A** - Paint peeling is caused by poor surface preparation (dirt, oil, moisture), inadequate adhesion, moisture behind paint (especially exterior), incompatible layers, or applying paint in poor conditions. Proper preparation, primers, compatible products, and good application conditions prevent peeling. Once it peels, you must scrape, prep, and repaint.

**89. C** - Alligatoring creates deep cracking patterns resembling alligator skin from incompatible paint layers or improper application. It happens when topcoats dry faster than underlying layers or when incompatible products layer (oil over latex without proper prep). Prevention requires compatible products, proper prep, and not over-thinning.

**90. B** - Ideal painting temperature is 50-85°F for most paints. Below 50°F paint dries too slowly or won't cure properly. Above 85°F paint dries too fast causing lap marks and poor leveling. Follow manufacturer temperature recommendations—some newer paints work outside this range.

**91. A** - Hardwood acclimation is storing flooring in installation spaces before installing allowing wood to adjust to the space's temperature and humidity. Wood expands in humidity, shrinks in dryness. Acclimation prevents post-installation expansion or contraction problems. Typical acclimation is 3-14 days depending on conditions.

**92. D** - Acclimation allows flooring moisture content to equilibrate with installation space preventing expansion (buckling, cupping) or contraction (gapping) after installation. Wood constantly adjusts to surrounding humidity. Installing non-acclimated flooring that's significantly wetter or drier than the space causes problems within weeks.

**93. C** - Tongue and groove hardwood has interlocking edges—one edge has a protruding tongue, the opposite has a receiving groove. The tongue of one board fits into the groove of the next creating tight connections. This traditional milling provides structural connection, reduces squeaks, and creates beautiful floors.

**94. A** - Engineered hardwood (thin hardwood veneer over plywood or HDF core) is more dimensionally stable than solid hardwood, can install over concrete and below grade, handles humidity changes better, often costs less, and installs faster. Solid hardwood is thicker, can be refinished more times, and some prefer it for longevity.

**95. B** - Expansion gaps around room perimeters (typically 1/2 inch) allow hardwood to expand without buckling. Wood expands in summer humidity, contracts in winter dryness. Without expansion gaps, flooring has nowhere to go when expanding causing buckling. Baseboards hide the gaps.

**96. D** - Typical hardwood expansion gap is 1/2 inch around all room perimeters providing adequate expansion space for seasonal moisture changes. Larger rooms might need larger gaps. The gap accommodates worst-case expansion preventing buckling. Baseboards and quarter-round cover gaps maintaining appearance.

**97. A** - Floating floors aren't attached to subfloors—they "float" as integrated units over underlayment. Pieces interlock connecting to each other not the substrate. Floating floors accommodate subfloor

movement, install quickly, can be removed, and work over problematic subfloors. Laminate, engineered hardwood, and LVP commonly use floating installation.

**98. C** - Vapor barriers under hardwood on concrete prevent concrete moisture from migrating into wood causing cupping, warping, and finish failure. Concrete always contains moisture even if seemingly dry. The barrier blocks moisture protecting expensive hardwood. Use appropriate barriers rated for flooring applications.

**99. B** - Underlayment under laminate and floating floors provides sound dampening reducing hollow sound and footfall noise, minor moisture protection, and smooths minor subfloor imperfections. Some underlayment includes vapor barriers. Proper underlayment dramatically improves floating floor performance and comfort.

**100. D** - Click-lock flooring (also called fold-and-lock or click-together) has mechanical interlocking edges requiring no glue or nails. Pieces angle together and click securely locked. Installation is fast, forgiving, and allows future removal. Most modern laminate, engineered hardwood, and luxury vinyl use click-lock systems.

**101. C** - LVP (Luxury Vinyl Plank) is waterproof resilient flooring resembling hardwood with photographic wood grain images protected by clear wear layers. It's 100% waterproof, durable, affordable, easy to install, and available in countless styles. LVP has become extremely popular for its combination of appearance, performance, and value.

**102. B** - SPC (Stone Plastic Composite) vinyl flooring has rigid cores made from limestone powder and PVC creating extremely stiff stable planks. The rigid core won't flex, telegraphs fewer subfloor imperfections, and provides very stable flooring. SPC is 100% waterproof and dimensionally stable.

**103. D** - WPC (Wood Plastic Composite) vinyl flooring has cores made from wood fiber and plastic creating softer more cushioned planks than SPC. WPC feels warmer and softer underfoot, provides sound dampening, and is more forgiving of minor subfloor imperfections. It's also 100% waterproof.

**104. A** - SPC is rigid with hard stone-plastic cores providing very stiff stable flooring. WPC is softer with wood-plastic cores providing cushioned flexible flooring. SPC is thinner, denser, and less forgiving. WPC is thicker, warmer, and more comfortable underfoot. Both are waterproof and durable—choose based on preference.

**105. C** - Baseboards cover gaps between walls and flooring (expansion gaps, uneven floor edges, drywall irregularities) providing finished appearance and protecting wall bases from damage. They're primarily cosmetic and protective, not structural. Baseboards are essential trim elements making rooms look finished.

**106. B** - Coping cuts the profile of one baseboard piece to fit tightly against another at inside corners. You install one piece square to the wall, then cope the second piece cutting its end to match the first piece's profile. Coped joints stay tight as wood shrinks; mitered joints open gaps.

**107. D** - Coped joints maintain tight fits as wood shrinks and swells with humidity changes. The negative profile fits the positive profile maintaining contact. Mitered joints have two 45-degree angles meeting—as wood shrinks, gaps open. Coping takes longer but provides far superior long-term appearance in inside corners.

**108. A** - Competent persons are trained individuals able to identify hazards and authorized to take immediate corrective action. They're required for trenches, scaffolding, fall protection, and other hazardous operations. Being "competent" isn't just job title—it requires specific knowledge and authority protecting workers.

**109. C** - Lockout/Tagout (LOTO) procedures control hazardous energy during equipment maintenance or service. Energy sources (electrical, hydraulic, pneumatic, mechanical) are locked out and tagged preventing accidental energization that could injure workers. LOTO saves lives preventing machinery startup during maintenance.

**110. B** - Lockout/tagout prevents equipment from accidentally energizing during maintenance. Without LOTO, someone might start equipment while you're working on it causing death or serious injury. LOTO physically locks energy sources off and tags them identifying who's working and warning against energization.

**111. D** - Personal lockout devices are individual locks each worker places on energy isolation points. Only the person who installed the lock can remove it ensuring equipment stays de-energized until they finish work. Multiple workers use multiple locks on group lockout devices ensuring everyone's safety.

**112. A** - Hot work permits authorize welding, cutting, grinding, or other spark-producing operations documenting fire prevention measures. They verify combustibles are removed or protected, fire watch is assigned, extinguishers are available, and the area is safe. Hot work causes fires—permits ensure proper precautions.

**113. C** - Before hot work, verify fire watch is assigned, flammable materials are removed or protected 35+ feet away, fire extinguishers are immediately accessible, ventilation is adequate, the area will be monitored during and after work, and the permit is properly authorized. Never skip hot work precautions.

**114. B** - Fire watch is a designated person monitoring work areas during and after hot work operations watching for fires or smoldering materials. They must have fire extinguishers and know how to use them, be able to raise alarms, and understand they're dedicated to fire watch—no other duties.

**115. D** - Fire watch must continue at least 30 minutes (some standards require 60 minutes) after hot work completion watching for delayed ignition. Sparks can smolder in hidden spaces, insulation, or combustibles igniting hours later. Extended fire watch catches delayed fires while responders are available.

**116. C** - Fall protection plans document elevated work hazards identifying all fall exposures, specifying protection methods (guardrails, personal fall arrest systems, safety nets), establishing access controls, assigning responsibilities, and ensuring everyone understands fall prevention. Written plans ensure systematic fall protection.

**117. B** - Controlled access zones are designated areas limiting access to workers performing specific elevated tasks. Lines, ropes, or barriers mark boundaries and signage warns of restrictions. Only authorized trained workers enter controlled access zones. They prevent unprotected workers from entering fall hazard areas.

**118. B** - Warning line systems use ropes or chains at least 34 inches high marking boundaries on low-slope roofs. Workers beyond warning lines (near roof edges) need fall protection. Workers inside warning lines are safe from edges. Warning lines help monitor worker positions and prevent edge exposure.

**119. D** - Safety monitors are designated competent persons who watch workers, warn them before approaching roof edges, are on the same work area with clear sight lines, have no other duties, and prevent workers from approaching unprotected edges. Safety monitors work with warning line systems.

**120. B** - Safety monitors replace fall protection only in very limited situations on low-slope roofs (2:12 pitch or less) when conventional fall protection is infeasible and specific conditions are met including small work areas, close monitoring capability, and other stringent requirements. It's rarely the preferred method.

**121. C** - Excavation competent persons inspect excavations daily before workers enter checking soil classification, protective systems adequacy, water accumulation, atmospheric hazards, adjacent loads, cracks or sloughing, and any condition changes. They must have authority to stop work and correct problems. Daily inspection is mandatory.

**122. B** - Type A soil is most stable with unconfined compressive strength of 1.5 tons per square foot or greater. It includes clay, silty clay, and hardpan—cohesive soils with high strength. Type A soil can be sloped 3/4:1 (53 degrees) and requires less protection than weaker soils.

**123. D** - Type C soil is least stable with unconfined compressive strength of 0.5 tons per square foot or less. It includes granular soils (sand, gravel), submerged soil, or soil with water seeping. Type C requires maximum protection—steepest slopes (1-1/2:1 at 34 degrees) or shoring.

**124. A** - Minimum trench width for worker access is 18 inches. Narrower trenches don't provide adequate working space or egress. Workers must be able to move, work, and escape. Wider trenches are safer providing better access, more room for protective systems, and easier emergency response.

**125. C** - Sloping excavations means cutting sides at safe angles based on soil type preventing cave-ins. Type A soil slopes 3/4:1, Type B slopes 1:1, Type C slopes 1-1/2:1. Proper sloping provides stable excavations without shoring or shielding. It's the simplest protective method for shallow excavations.